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Replies to Dr. Harrison Shall to the questions transmitted by Comrade V. A. Filippov.

In the event that Dr. Shall is absent please give this to Dr. David Beckler.

[s] E. Sklyarov

9/2/1974

Science Policy

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Section I. How is basic research planned in the USSR?

1. What mechanisms determine the overall level of support for basic sciences? How are the overall goals of the basic sciences determined?

The planning of basic research in the USSR is a part of the overall planning of scientific research and development in the country. The overall level and the goals of the basic sciences, as is the case with all Soviet sciences, are determined by the Directives of CPSU Congresses, as well as by the appropriate decisions of the Central Committee of the Communist Party and of the Soviet Government. The development of future, five-year and one-year plans for scientific research is a component part of overall state planning.

The preparation of plans for scientific research, including basic research, is preceded by the development of the main directions for the development of science and technology for the forthcoming five-year period. Proposals for the main directions of basic research in the natural and social sciences are worked out by the Academy of Sciences of the USSR together with the academies of sciences of the Union Republics, institutions of higher learning and Ministries and Agencies, and are coordinated with the State Committee of the Council of Ministers of the USSR for Science and Technology, and with respect to research in economic sciences -- with the State Planning Commission of the USSR.

The overall goals for the development of basic sciences are related to the resolution of the principal social and economic problems of the Soviet state: the economic and cultural progress of society and the constantly increasing prosperity of the nation. Plans for basic research are prepared on the basis of the economic and political problems of the country, the needs of technical progress as well as the development of science itself.

The planning for the development of basic sciences within the State Plan has a recommendational character rather than a mandatory one. Considering the fact that as a practical matter it is impossible to foresee in advance in what area of basic sciences and precisely when a new important discovery or a decisive advance will be achieved, it is not considered advisable to make the State Plan specific with respect to the development of basic sciences.

2. What determines the priorities and allocation of resources for basic sciences?

The analysis of anticipated income and profits from the implementation of the results of basic research plays a relatively small part in the determination of the importance of research planned for execution.

During the process of thematic and financial planning the importance of individual scientific directions, as well as the amounts of necessary allocations granted to the scientific research institutions of the academies of sciences of the USSR, are determined by the Sections of the Presidium and the branches of the Academy of Sciences of the USSR. The scientific councils on the most important problems, attached to the Academy of Sciences of the USSR, take an important part in this work. Decisions on priorities and provision of resources are based on the judgements of highly qualified specialists; in this connection the following criteria are used: the probability of a scientific breakthrough, the existence of a stock of preliminary scientific knowledge, the possibility of utilizing the results in other areas of basic science and in applied research, the existence of an appropriate material and technical basis, etc.

First of all those scientific areas receive financing in which there is a large number of highly qualified specialists and in which scientific schools have been established.

The preparation of subject matter for an institute's work is the province of the institute's director and scientific counsel. The plan to be financed out of the budget includes only those topics whose scientific importance and promise have been given adequately convincing substantiation by the scientists authoring proposals.

In the Academy of Sciences of the USSR all the projects which are provided for in the plans of the institutes are financed out of the general budget. Therefore, when financing is within the framework of the budget the problem of selecting a scientist to carry out a given project does not arise. In distributing additional resources allocated for accelerated development of individual scientific direction, first of all financing is provided through institutes which over a period of years have proved themselves capable effectively to use the resources allocated.

In our country not only the leading scientific directions of basic research are financed by resources from the budget, but also "forgotten" areas of science, which at the present time appear to be less promising. Such a system of financing

is most suitable to the nature of fundamental research, since the history of science, particularly during the recent decades, contains many examples when it was precisely in the "forgotten" areas that outstanding discoveries were made.

The possibility of implementing research projects that are new in principle, requiring substantial expenditures and involving risks, is governed by the ability of a given scientist to convince the scientific staff of his institute and the Presidium of the Academy of Sciences of the USSR of the promise of the research he proposes.

3. What is the authority of scientists, directors of institutes, chiefs of laboratories, the Presidium of the Academy of Sciences of the USSR and the State Committee for Science and Technology as regards the formulation of programs and projects for fundamental research?

In our country the authority of scientific organizations, officials and scientists, with respect to the formulation of programs and projects is determined by the procedure for planing basic research.

The five-year plans for scientific research in natural and social sciences are developed by the branches of the Academy of Sciences of the USSR, and after consideration by its Sections, are sent to the Presidium of the Academy of Sciences of the USSR for approval. The branches, together with the scientific councils at the Academy, develop coordinating plans for the problems in natural and social sciences, as well as for scientific and technical problems.

Although the scientific councils are consultative bodies, their recommendations carry great weight in formulating programs and projects for basic research for the Presidium, the branches and institutes of the Academy of Sciences of the USSR, as well as for the academies of sciences of Union Republics and institutions of higher learning.

A scientific council systematically receives information from the implementing institutions on the progress of research being carried out, as well as materials of conferences and symposia. On the basis of this information and with an account for the development of science abroad, the council develops basic recommendations on the directions and content of further research in a given field.

The scientific institutions of the Academy of Sciences of the USSR prepare annual thematic plans for work to be carried out on the basis of the five-year plans and targets provided for in the coordinational plans.

In preparing plans for basic research the scientific institutions take into account the recommendations of scientific councils and the proposals of scientific collectives and individual scientists. The directorate and the scientific council of an institute consider ~~proposals~~ proposals for new programs of basic research whose direction must not go beyond the overall framework for the activity of the institute that has been affirmed by the Presidium of the Academy of Sciences of the USSR. Scientists participate very extensively in proposing scientific projects: through the scientific council of an institute, the directorate, the council of scientists, a branch and the Presidium of the Academy of Sciences of the USSR. The procedure for considering research projects is characterized by the collective nature of evaluating projects with extensive participation of experts at each stage of consideration. The financing of new projects is implemented through the institutes, inasmuch as the directorate is the body which allocates credits and takes decisions on all questions concerning distribution of funds. If necessary, an institute's directorate may apply for additional allocations from the funds of the Presidium of the Academy of Sciences of the USSR or the State Commitee for Science and Technology.

In formulating programs and projects for basic research the role of the personnel of planning organs consists mainly in coordinating the targets with scientific institutions, and also in coordinating research.

4. To what extent and by what means is the direction of basic research related to the achievement of specific social goals?

In resolving such complex problems as cancer, since they are ~~complex~~ many-sided, academic research institutes and institutes of higher learning take part along with the scientific institutions of a specific discipline (in this case medicine). In ~~developing~~ working on such problems, the goal of basic research, specifically that carried out by the Academy of Sciences of the USSR, is, first of all the clarification of the most important theoretical questions which are basic for the solution of the problem as a whole. As a rule, the program of basic research on a given problem is developed by the leading scientific institution in that field. The various tasks involved are distributed among implementing institutes, in accordance with their scientific profile, and are included in the plans of these institutes.

Then the results of basic research are transmitted to the leading scientific organization implementing coordination of the work on that problem.

In the process of developing five-year and one-year plans for basic research the Academy of Sciences of the USSR considers proposals from Ministries and Agencies for its work or participation in the development of scientific problems which are urgent for industry. If the Academy of Sciences of the USSR recognizes a proposal as useful, the appropriate subject matter is included in the plans of the institutes of the Academy. The initiative for carrying out such research may also originate in the scientific institutions of the Academy of Sciences of the USSR or with individual scientists; usually these are proposals from institutes and scientists whose research is already involved with industry. In individual cases direct agreements may be concluded between the institutes of the Academy of Sciences of the USSR and industry, providing for scientific research on a profit and loss accounting basis.

Applied research, as a rule, is carried out in industrial institutes and, in part, in institutions of higher learning. Within the framework of basic research, which comprises the larger part of research carried out by the institutes of the Academy of Sciences of the USSR, the possibility of transformation of the research into an applied phase and later the development phase, is determined during the course of the work on the specific subject and in dependence upon the importance of the potential results of applied research.

Section II. In the USSR, how is financing of basic research organized in broad and narrow areas of science?

5. In the USSR, how is long term financing of projects assured, which of necessity are of a long-term nature? How is stability assured under the conditions of a priority for basic research which changes from year to year?

In our country financing of long-term subjects which carry on from year to year for a number of years is accomplished by annual financing of basic research primarily out of the State Budget.

The necessary stability is achieved by an established procedure of future planning of scientific work. Annual research plans are prepared within the framework of the five-year plan. In preparing basic research plans for the next five-year period the continuing projects are necessarily taken into account and are also included in the new plan. This is how their financing is ensured for a

new period of time.

The stability of the subject matter of our basic research is, in the final analysis, determined by the priority of the most important scientific directions for each five year period, which is the basis for preparing plans for scientific research.

Interim results, received in the course of carrying out long-term research, are discussed by the scientists' councils of institutes and in the event that they are very important, ~~but~~ by the scientific councils attached to the Presidium of the Academy of Sciences of the USSR. When necessary the discussion of such results can also be carried out in the branches or sections of the Presidium of the Academy of Sciences of the USSR. The Presidium of the Academy of Sciences of the USSR receives the scientific reports of the leaders of specific research projects.

6. What are the various sources of financing and by what means do the funds from a specific source come to the organization carrying out research?

The principal source for the financing of scientific research in the USSR is the State Budget. It ensures that the overall expenditures for science are covered to the extent of more than 60%.

The amount of expenditures for scientific research and the sources of financing are determined for each scientific institution separately, and for institutions included in the budget, are affirmed in the form of an estimate of expenditures. The estimate is the basic plan document which determines the annual amount of expenditures, the sources of financing, the purpose of expenditure of funds and their distribution by quarters of the year.

The State Committee for Science and Technology may grant the Academy of Sciences of the USSR additional allocations, out of its own reserve, over and above the amount of expenditures established for the Academy, in the case of most important scientific research projects.

The Scientific research instititions of the Academy of Sciences of the USSR may also carry out scientific research and experimental design work on the basis of contracts with customers over and above the amount of expenditures established for scientific research in the national economic plan. Funds received from customers for contract work planned in an estimate of expenditures are used for reestablishing credits and are disbursed to cover expenditures for implementation of thematic plans of research.

The planning organs of the Presidium of the Academy of Sciences of the USSR analyze and inspect the funds balances of scientific research institutions. In addition, periodic financial audits are carried out to check the state of financial and economic activities of scientific research institutions.

Establishment of organizations for the purpose of carrying out basic research is not provided for within the framework of current financing. There is a single nationwide policy of developing scientific research in individual, economically promising, regent regions of the USSR, within the framework of which it is planned to establish new regional centers and individual organizations for the purpose of carrying out basic research.

7. What are the mechanisms of financing in the USSR? How are funds distributed among them?

Budget allocations for science are given to each Ministry and Agency in accordance with annually affirmed plan for financing scientific research a plan for financing scientific research which is affirmed annually by the Council of Ministers of the USSR. Expenditures for science are planned without specific allocation of expenditures for basic research or scientific and technical (applied) research and development. Ministries and Agencies allocate to the scientific research institutions subordinate to them only the total sum of expenditures. On the basis of an analysis of accounts of the Ministries and Agencies relating to the progress of implementing scientific research plans and financing scientific research, the State Committee when for Science and Technology, when necessary, redistributes financial resources between Ministries and Agencies.

In addition to budget allocations, scientific research is financed by Ministries and Agencies out of their own funds. Non-centralized proprietary funds, used for financing research are at the disposal of enterprises and organizations and are accumulated from savings due to lowering cost of production.

The scientific research institutions of the Academy of Sciences of the USSR, engaged in basic research, may also carry out scientific and technical (applied) development pursuant to contracts entered into with the organizations of Ministries and Agencies.

For the purpose of encouraging interdisciplinary research carried out in accordance with the coordination plans for the solution of basic scientific and technical problems, which are included in the five-year plan, the State Committee for Science and Technology has a reserve of financial resources deducted from overall

budget allocations for science.

8. In the USSR, how is auxilliary activity financed, which is intended to support basic research?

In the USSR, the estimate of expenditures of scientific research institutes included in the budget contains a separate item used for planning allocations for scientific instruments and equipment.

The requirements for scientific equipment for the Academy of Sciences of the USSR as a whole are computed on the basis of adding up the requirements of individual organizations, contained in the applications which they submit periodically. The Academy of Sciences acquires equipment produced by plants in the USSR as well as abroad.

The initial equipment, installed in new buildings, is acquired under the capital construction item of the estimate of expenditures. Development and production of individual unique instruments and items of equipment is carried out in the design offices and at factories of the Academy of Sciences of the USSR, as well as in the design departments, workshops and experimental production units of individual scientific research institutions.

Requirements for bibliographic data are satisfied by the publication of reference journals, the issues of "Express Information," "Science Results" and other bibliographic materials which are the responsibility of the All-Union Institute for Scientific and Technical Information (VINITI). VINITI also satisfies applications from scientific research organizations for the translation of foreign publications and compilation of special bibliographic reviews with the aid of modern computer technology.

The budget estimates of scientific research institutions provide for expenditures for repairs to instruments and equipment; expenditures are determined on the basis of actual need; in the summary calculation and estimate the ratio of these expenditures is fixed in relation to the residual cost of instruments and equipment.

Section III. How is a basic research program carried out in the USSR.

9. What are the mechanisms used in the USSR to determine whether basic research corresponds to planning? In the USSR, how is control exercised over research which is in the implementation stage?

Whether basic research corresponds to planned research is established by analyzing annual reports. The institutes of the Academy of Sciences of the USSR

transmit annual reports on implementation of basic research to the branches of the Academy of Sciences of the USSR. The reports of the directors of institutes are also discussed at meetings of the bureaus of the branches and sections of the Presidium of the Academy of Sciences of the USSR. The results of basic research and major projects on specific problems are considered by the scientific councils attached to the Academy of Sciences of the USSR. In addition, completed research on natural sciences is as a rule evaluated by special commissions appointed by the branches or the Presidium of the Academy of Sciences of the USSR.

Scientific achievements in the natural and social sciences by the institutions of the Academy of Sciences of the USSR, the academies of sciences of the Union Republics, the institutions of higher learning and the specialized scientific research institutes are discussed annually at the General Meeting of the Academy of Sciences of the USSR.

In the Academy of Sciences of the USSR as well as in Ministries and Agencies, control over implementation of plans for scientific research and over the activities of the institutions, to assure that they correspond to approved scientific directions, is also carried out systematically in the course of intra-agency comprehensive audits of the institutes (once in three or four years).

Control over research in the stage of implementation is the responsibility of the directors of institutes.

10. What are the mechanisms used for:

1) selection of institutes or laboratories for carrying out planned research? 2) the establishment of new research centers and laboratories? In the USSR, to what extent is purposeful competition encouraged between scientific research in organizations in carrying out basic research?

The planning bodies select one scientific institution or another for the purpose of carrying out planned research as follows:

by compiling a list of organizations engaged in corresponding basic research and examining the scientific activities profile that is closest to the newly planned work;

by evaluating the scientific personnel and the material and technical base of these organizations and by narrowing the range of possible implementors;

by evaluating the possibility of a specific organization carrying out the given task.

A similar analysis is made by the scientific councils on problems of natural and social sciences when preparing coordination plans for basic research.

New research centers are established after thorough discussion of the problem in the Academy of Sciences of the USSR (or in academies of sciences of the Union Republics) and by considering all aspects of the problem. Proposals are transmitted to the government of the USSR. Decisions regarding establishment of a scientific center are taken by government bodies. Establishment of a new scientific institution is carried out by the State Committee of the Council of Ministers of the USSR for Science and Technology pursuant to requests from the Academy of Sciences of the USSR (or from an Agency, after agreement with the Academy of Sciences).

For the purpose of preventing a monopoly position in the development of any scientific direction of basic research, when necessary, scientific institutions are established which carry out research in related directions, or such research may be entrusted to already existing scientific institutions which, as a rule, are subordinate to other agencies. At the same time, measures are taken to prevent excessive duplication of scientific research.

11. What special mechanisms and methods exist to provide for maximum efficiency in utilization of scientific personnel?

Annually approximately 15% of the graduates of ~~higher education~~ of higher learning institutions are brought into scientific work. The most capable young specialists are found with the help of the following: a broad network of student scientific, designing, planning and technological organizations in which students fulfill course and diploma work in accordance with the tasks set down by scientific institutions and industry; the pedagogical activity of scientists of the Academy of Sciences of the USSR in ~~higher education~~ of higher learning institutions, in the process of which the most talented students are selected for subsequent work in the institutes of the Academy; training of students in academic institutes; the possibility of entering graduate school immediately upon completion of a ~~higher education~~ of higher learning institution. The Academy of Sciences of the USSR has regular conferences and competitions, at which the works of young scientists are discussed and their best works are subsequently published. The Presidium of the A.S. [Academy of Sciences] of the U.S.S.R. awards prizes for the best works of young specialists.

To improve the scientific level of young specialists working in the area of applied research and in industry, specialized graduate study and training in the institutes of the A.S. of the USSR are used.

Older scientific personnel desiring to continue scientific work in the institutes of the A.S. of the USSR to the extent that they are able, are made scientific consultants.

Scientific councils of the institutes of the A.S. of the USSR periodically review reports of laboratories on the results of their activity and discuss them.

If certain research is judged to be unpromising or the institute changes the direction of its work, a reorganization of certain of its scientific subdivisions is possible; in such cases scientific personnel thus freed switch over to research in the new, more promising directions. As a rule

the switchover is carried out on the basis of the desires of the scientific personnel themselves, who express a desire to work in the new directions.

12. Is any basic research carried out in the USSR in industry? How is it organized and how is the level of such research determined?

Basic research is conducted primarily in the institutes of the A.S. of the USSR. In addition, part of basic research is carried out in ~~higher education~~ institutions of higher learning (universities) and in scientific research institutes of specific ministries. As a rule such research is primarily oriented toward the immediate solution of practical problems. Approval of such research plans as well as their financing is given directly by the corresponding ministry.

Scientists working in scientific institutes of the ministries keep in touch with scientists of the institutes of the A.S. of the USSR either directly or through scientific councils, and by organizing joint scientific conferences.

13. What is the policy and practice in the USSR with regard to transfer of scientists from one area into another?

A scientist in the USSR can choose the area of his activity and freely transfer from one scientific institution or educational institution to another. With regard to government policy in this matter, it relies upon the principle of expedient use of scientific personnel. This principle is supported by the planned nature of training of scientific personnel in the USSR, which is based on the necessity to optimally provide all branches of science, the national economy, and state and cultural development with scientific personnel. In planning the training of personnel, decisions are made as to which areas of science and specialized fields need trained specialists and which areas of science and specialized fields should be given preference

during the planning period; primary consideration is given to provide training of personnel for the basic areas of scientific research in the country.

Incentives for transfer of scientists from one institution to another or from one region to another depend on the degree to which this corresponds to national interests. For example, incentives are given for transfer of scientific personnel to those regions of the country where there is not enough of them at a given time. Utilization of scientific manpower in the area of basic research is based on similar principles.

With regard to participation of Soviet scientists in international scientific cooperation, specifically in the work of international scientific forums, this receives full approval and support in our country -- both from government organs and also from our scientific community. This is also reflected in a broader participation of the USSR in international exchanges of scientific personnel.

Section IV. What policies and mechanisms are there to facilitate the transfer of knowledge received as a result of basic research to institutions engaged in R&D of an applied nature?

14. What mechanisms does industry use to acquire and utilize the latest information received as a result of basic research?

The direct way of transferring information on problems of primary significance for industry which have not yet been solved by science is direct request by the specific agencies to the A.S. of the U.S.S.R., or the Academies of Sciences of the republics to conduct the basic research which is necessary for the industry. A significant role is played by the discussions of these questions at scientific and technical conferences in which

scientists of the academic institutes and industry specialists participate, and also in scientific councils of the A.S. of the USSR on problem areas. Direct working contacts between scientists and engineers are very effective, as is the conduct of joint work using the results of basic research.

Exchange of information between various organizations and institutions engaged in R&D for industry is carried out through central specialized organs for scientific and technical information.

In the USSR, the concept of "industrial secrets" does not exist as a matter of ~~in~~ principle. On the contrary, exchange of experience is encouraged. Information on discoveries and inventions is transmitted to industry after it has been registered.

Information on the results of basic research is also received by personnel from industry and other branches of the economy from scientific journals, collections of articles and monographs published by the A.S. of the USSR. The Academy is the largest publisher in the world. Its yearly volume reaches 50,000 author's sheets.

15. What means are used to stimulate the initiative of individuals to implement new ideas in the area of basic research?

In accordance with the Regulations on Discoveries, Inventions and Rationalization Proposals in force in the Soviet Union, the Government has the exclusive right to use inventions. The Soviet government takes upon itself the task of selling an invention through government, cooperative or public enterprises.

The author(s) of an invention receive(s) remuneration for its use if the invention:

-- is used in the national economy of the USSR;

-- is used in documentation transmitted to another country as a part of economic and scientific and technical cooperation;

-- is used at installations built by agencies and organizations of the USSR abroad as part of technical assistance to foreign countries;

-- is sold through sale of licenses abroad.

Remuneration for use of an invention is calculated separately ~~in accordance with~~ on the basis of each of the above factors.

The maximum amount of remuneration for a single invention cannot exceed 20,000 rubles.

For inventions whose use leads to the creation of new types of production, valuable materials, machines, manufactured products or medicines, the law provides for a possible increase of remuneration within the limits of the threefold maximum amount of remuneration.

For a discovery, a one-time monetary remuneration of 5,000 rubles is provided for.

Remuneration for a discovery or invention not exceeding 1,000 rubles is not taxable.

The legislation in force gives inventors the right to participate in preparing for the use of their inventions: in drawing up technical documentation, preparing and testing test samples and in organizing production.

Government agencies which have accepted an invention for use may use the technical documentation or model prepared by the author or instruct the author to perform this work. When this work has been carried out by the author without a working contract, the agency must conclude an agreement with the author which provides for payment for his work and reimbursement

for expenses encountered in preparation of documentation or models. The sums determined by such an agreement are paid to the author independently of remuneration for use of the invention.

An important method of government incentive is the right to give the author's name to a discovery or invention.

The granting of an author's name to a discovery or invention is indicated in the diploma for the invention, the author's certificate, and also in the technical documentation, on the product or on the wrapping.

In accordance with the legislation, authors of inventions may receive the title of "Honored Inventor of the Republic."

The authors of outstanding discoveries and inventions may be awarded the Lenin and State Prizes of the USSR, 12 gold medals engraved with the author's name and 37 prizes named in honor of outstanding scientists, established by the Presidium of the A.S. of the USSR, and inscribed prizes of the academies of sciences of the union republics and specialized academies.

Scientific-research institutes have special funds to be allocated as prizes to authors of discoveries and inventions.

Authors of discoveries and the more significant inventions have the right to be accepted into ~~higher education~~ institutions of higher learning without participating in the corresponding competition.

Inventors also have certain privileges in the area of social security.

The basic reasons which hold up the quick utilization of inventions are the following:

-- lack of well-defined criteria for evaluating the economic impact of inventions;

-- lack of auxiliary processes in certain cases to test inventions and prepare them for industrial utilization.

Section V. Are there any well-founded indicators for comparing the efforts undertaken in the U.S. and USSR in the area of basic research?

16. What similarities and differences are there between the American and Soviet programs of basic research?

This question is one of the most promising from the point of view of possible fruitful joint research. The basic aim of such research, in our opinion, must be the development of a methodological basis for comparative evaluation of the programs of basic research. In our opinion, one of the first stages can involve the development of an agreed classification of scientific areas, ~~of work.~~

Answers to questions raised by each side may help to better understand the similarities and differences between the American and Soviet programs of basic research.

Section VI. How are recomendations in the area of science and technology used in working out the policy and program of scientific research?

17. Through what mechanisms are recommendations in the area of science presented to the government for policy planning?

The State Planning Committee of the USSR and the State Committee of the Council of Ministers of the USSR on Science and Technology prepare scientific recommendations and present information to the government of the USSR on the utilization of scientific results of basic research. From the point of view of expertise or consultation, such recommendations may be prepared by the A.S. of the U.S.S.R., large institutes, scientific

scientific-
and/technical councils, scientists and highly-qualified specialists.

Persons responsible for making decisions can turn for scientific recommendations fo the A.S. of the USSR, academies of sciences of the union republics, ministries and agencies, the All-Union Council of Scientific and Technical Societies, scientists and highly-qualified specialists.

Important scientific information is presented by the A.S. of the USSR to the Council of Ministers of the USSR or to the State Committee on Science and Technology.

~~Preparation of~~ Recommendations in the area of science ~~is carried out~~ are prepared by individual departments of the A.S. of the USSR, which base their work on the work of institutes and scientific councils; leading scientists take an active part in preparing and discussing these resommendations. In preparing the recommendations, scientific research ~~enterprises~~ institutions and organizations also determine the scientists who are to be consultants. In each specific case consultants are chosen from those persons who are most competent in the matters under discussion; preference is given to members of the A.S. of the USSR.

The Presidium of the Academy of Sciences and the State Committee on Science and Technology present recommendations on the development of science which have been agreed between them and conduct joint consultations when necessary to achieve ~~this.~~ such agreement.

Recommendations on the development of science which serve as the basis for decisions by government agencies may also be presented by academies of sciences of the union republics or specialized academies.

Section VII. What mutual research may be fruitfully carried out by the Academies of Sciences of both countries?

18. What research has been completed in the last three years and what research is still in progress? Which problems could become the subject of future mutual research?

Joint scientific research on agreed programs between the A.S. of the USSR and scientific institutions of the U.S. began, practically speaking, at the end of the sixties-beginning of the seventies. The practice of scientific contacts and cooperation has already established priority problems which are important both for the peoples of our countries and also for the development of science as a whole. These are: protection of the environment, study of the world ocean, peaceful uses of atomic energy, MHD energy conversion, high-energy particle physics, and research on the fundamental properties of matter.

There is an agreement between the A.S. of the USSR and the National Academy of Sciences of the U.S. to assist scientific organizations of both countries which are not a part of the academies in the development of scientific cooperation.

At the present time, the following scientific projects are being carried out by the A.S. of the USSR and NASA:

1. Work on creating joint means of rendezvous and docking of Soviet and American manned spacecraft and stations and preparing the first experimental flight of the Soyuz and Apollo spacecraft, scheduled for 1975.

2. Study of near-earth space, the moon and planets. In 1972 and 1973 there were joint seminars and meetings of Soviet and American scientists on active experiments in the magnetosphere of the earth, on study of the planets, on non-colliding shock waves and on lunar cartography. In June 1974, there was a joint conference in Moscow on

space chemistry of the moon and planets.

There was an exchange of lunar samples returned to earth by the Luna-16 and Luna-20 automatic stations and the Apollo spacecraft, which landed on the moon. Photographs of the moon and lunar maps are being exchanged. There is an exchange of information received from the automatic stations Mars 2, Mars 3, and Mariner 9, data from radar soundings of Mars and Venus, detailed descriptions of the atmosphere and surfaces of these planets, and so forth.

3. Study of the environment with the help of satellites. There was an exchange of materials on the basic areas of joint work (geology and geomorphology, soil science, oceanology, etc.). In the summer of 1973 coordinated experiments were carried out in the Northwest Atlantic and Norwegian Sea to measure the temperature and coloration of ocean water using Soviet research vessels and American satellites.

4. In the area of space meteorology. In 1973 there was a joint experiment, "Bering", to simultaneously measure the ice cover, state of the ocean surface and study of the zones of precipitation in the Bering Sea with the help of microwave equipment. Ships and planes of both countries participated in the experiments.

There is a regular exchange of operational data from rocket sounding of the atmosphere.

5. Space biology and medicine. There have been four meetings of the Working Group of Soviet and American scientists on cooperation in this area. An exchange is being carried out of medical and biological data on the results of manned space flights.The joint work "Fundamentals of Space Biology and Medicine" whose publication is scheduled for the end of 1974, is nearing completion.

Within the framework of the inter-governmental Agreement on Cooperation in Science and Technology, scientists of the A.S. ~~of the A.S.~~ of the USSR and American scientific institutions and companies are also engaged in cooperative efforts in the area of chemical catalysis, development and creation of MHD power stations, cryogenic technology, special metallurgy and electric welding, and use of computers in management.

The above examples of cooperation do not completely exhaust the areas of cooperation in which scientists of the A.S. of the USSR and American scientific institutions are participating. Cooperation on these problems is of a long-term nature and will involve several years work.

The range of scientific cooperation between the academies can be quite broad. Mutual research could be fruitfully conducted, for example, on several problems in the area of earth science, biology, and also in the area of agricultural utilization of arid zones.

No Bio Data.

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ENCLOSURE 6

E45 file

sci. policy

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D.C. 20418

July 31, 1974

Dr. V. A. Filippov
Head, Science Organization Department
Academy of Sciences of the U.S.S.R.
Leninskiy Prospekt, 14
Moscow, U.S.S.R.

Dear Dr. Filippov:

In his letter to you of July 20, 1974, Dr. Shull indicated that we have been preparing brief proposals for case studies of selected issues identified in the list of questions on fundamental science included in the materials provided to us by Dr. Sklyarov last June.

We have now completed a preliminary list of possible case studies related to some 18 issues in which you have expressed an interest in U.S. experience. This list of issues will be considered and revised as necessary by a National Academy of Sciences Committee which will meet during the last week in August under Dr. Shull's chairmanship.

Science policy

At Dr. Shull's request, I am enclosing a copy of the preliminary list of case studies which we will be considering, with the thought that it may be of assistance in developing your list of studies and in your preparation for the joint working group meeting now scheduled for the week of September 23rd in Moscow. It was decided not to delay in sending you our suggestions until after Dr. Shull's committee meets, since there is very little time between the meeting of his committee and the scheduled discussions in Moscow. The final statement of suggested case studies will be sent to you as soon as it is agreed by the National Academy committee. Your early reactions and comments on our preliminary list will, of course, be most helpful in finalizing our proposal. In accordance with the study plan jointly agreed last November, four to six of these studies would be selected for implementation based on discussions at the joint working group meeting.

There are two other matters that we would like to raise at this time:

1. In his letters of February 28 and July 20, Dr. Shull mentioned the desirability of each side preparing general survey papers dealing with a discussion of policy planning, basic research management, and the transfer of basic research to technological application. These survey papers would describe the principal features of our respective systems for fundamental research and provide a framework for comparison of the two systems,

supplementing the in-depth examinations of particular issues through case studies. We hope that plans and procedures for preparing such survey papers can be agreed upon at the joint working group meeting in Moscow. We have in mind that each side would designate experts to prepare the survey papers. The corresponding experts would collaborate in outlining their surveys so as to facilitate comparison of functionally similar features of the two systems, and would exchange visits in the course of their work.

2. Two topics included in Dr. Shull's letter of February 13th were not covered by the list of questions you submitted via Dr. Sklyarov; namely,

   a. What are the mechanisms by which the best scientific advice is made available to the government for policy planning, and

   b. What joint studies may profitably be carried out by the two Academies? (Perhaps a single joint study could be initiated as an experiment in making a joint scientific assessment of a problem of mutual interest to the U.S. and the U.S.S.R.)

We hope that you will agree to include these two topics on the agenda for the September meeting for discussion as to the desirability of including them in our joint program of studies.

I would appreciate your informing me, through Dr. Tech at the U.S. Embassy, which institutes and organizations outside of Moscow it will be possible for the U.S. delegation to visit, if such visits can be arranged during the week of September 15 as suggested in Dr. Shull's letter. He also mentioned that several members of our team may be able to remain in the Soviet Union the week after our joint working group meeting. The following possibilities occurred to me for visits prior to the week of September 23rd: meetings with appropriate individuals at the headquarters of the U.S.S.R. Academy of Sciences, the State Committee for Science and Technology, the Gosplan, the Trapeznikov Management Institute, a visit to a "science city" near Moscow. A visit to Novosibirsk following the week of September 23rd would be of interest to some members of the U.S. group. We will depend on your judgment as to the individuals, institutes, and organizations that could provide us with a spectrum of views and experience related to the topics and questions identified in our joint study.

In closing, it was a great pleasure to meet Mr. Nemchinov during his visit to Washington last June, and I look forward to renewing our association in Moscow in September.

Most sincerely,

INDIANA UNIVERSITY
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TEL. NO. 812—

July 20, 1974

Dear Dr. Filippov:

We were delighted to receive the 29 questions relating to four subdivisions of Topic IV, Systems of Stimulating the Development of Fundamental Research. We have studied these questions carefully, and we believe that they can form the basis of a meaningful exchange of information between us.

We are now preparing brief study plans for a number of these and are arranging for our team of experts to review these in the near future. In order to expedite the cooperative work, however, we will be forwarding to you in advance of that review the draft summaries. Some modifications and additions can be expected by this group, but we hope the result will not differ significantly in form from the advance documents, and these may give you then some indication of the nature of our proposals.

Some of your questions can be grouped, we believe, in a way to be answered properly through several, perhaps three, survey papers dealing respectively with a description of policy planning, a discussion of basic research management, and a survey of the transfer of basic research to technology. Many of the others can best be illuminated by a series of case studies descriptive of actual situations we have encountered in recent years.

Altogether we hope to forward to you summaries of 10-15 such studies with a view towards our mutual selection of 4-6 of these for implementation at our next meeting.

As Dr. Beckler has written to Dr. Sklyarov, we hope to be ready to meet with you in the week of September 23 to discuss and to reach conclusions on these studies to be carried out by each side as agreed in the earlier protocol. I propose bringing four or five individuals from my team to facilitate this discussion. In addition I am hoping to bring my wife and one other member of the group presently plans to bring his wife.

We believe it would be most productive of our time to plan to arrive in the Soviet Union on Sunday, September 15. Allowing for the usual problems with jet lag, we would appreciate the opportunity of visiting installations in the Moscow-Leningrad area during that week in order for us to obtain the maximum benefit of understanding of the questions you have raised. We propose that formal meetings of the groups be held the first half of the week of September 23, leaving the latter part of that week for producing the formal protocol of the discussions.

Several of us may be able to remain in the Soviet Union the following week as well, and we hope to have the opportunity of visiting some other parts of your great country, perhaps combining both scientific and touristic purposes.

We hope these suggestions meet with your approval. We certainly are eager to press forward with this important opportunity for exchange of information and for further contacts between us. We look forward to the prospect of seeing you in Moscow in September.

Sincerely,

Harrison Shull

Harrison Shull

HS:mk

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Joint Study of U.S. and U.S.S.R. Systems for Fundamental Research

Subdivision 1. Development and Implementation of Science Policy in the Field of Basic Research

Issue 1. What mechanism is used to redistribute resources in basic science in the case of a change in scientific policy connected, for example, with changes in governmental policies?

Basic scientific research is supported by a number of government departments and agencies as a part of their applied mission responsibilities. Within the federal government, only the National Science Foundation supports basic scientific research for its contribution to scientific knowledge. There is no predetermined overall level of support of basic science either within federal agencies or within the Science Foundation.

A case study could examine the role of the National Science Foundation in providing continuity of support for meritorious research that is terminated or greatly reduced in funding by government agencies with applied missions. Specifically, it would examine the role of the National Science Foundation in assuming responsibility for the support of research programs terminated as a consequence of:

a. decisions by the Department of Defense to curtail basic research programs in materials sciences and other fields of science, based on considerations of "relevance" to its mission.

b. a decision by the National Institutes of Health to reduce its support of basic research in chemistry.

c. a decision by the Atomic Energy Commission to reduce it support of nuclear physics.

The case study would, in particular, explore the policy-decision making process that led to increases in funding of basic research by the National Science Foundation as a consequence of actions of other agencies. The study would explore judgmental questions concerning the support of projects proposed for transfer of support in competition with other projects and programs proposed for support by the National Science Foundation.

Issue 2. What happens in the case where financing of basic research is terminated within the frame of a particular scientific field or within a scientific research organization?

Case studies could examine the problem of utilizing basic research capabilities and facilities that are no longer needed for their original scientific purposes, for example:

a. The termination of the biological warfare research laboratory at Fort Dietrich, Maryland, following the international agreement to ban biological warfare. The process, problems, and benefits of converting this facility into a center for research on cancer would be assessed, including questions of retention and transfer of trained personnel, and the financial considerations involved.

   A similar case study could be undertaken on the conversion of the biological warfare facility at Pine Bluff, Arkansas, to an environmental health center for research on effects of long term low-level exposures to chemicals.

b. A different situation is involved in the closing of high energy particle accelerators whose scientific productivity has declined; such facilities as the Princeton-Pennsylvania Universities' accelerator, the Cambridge Electron Accelerator at Harvard, the Cosmotron at Brookhaven National Laboratory. This case study could illuminate the decision-making process that resulted in the decisions to close these facilities, the options examined for alternative sources for support, and the plans and problems of phasing out the facilities and trained personnel.

c. The Oak Ridge National Laboratory of the Atomic Energy Commission suggests still another possibility for a case study. In the thirty-year period since World War II, part of the original mission of the laboratory has been satisfied and the laboratory leadership has in recent years attempted to diversify its mission and turn some of its scientific and engineering talents toward environmental and biomedical research problems. An analysis of the laboratory's response to changing requirements and national needs and its success and difficulties in turning in new directions may be of interest to the U.S.S.R. side.

Issue 3. Is there feedback from the results of fundamental research to scientific or general government policy in the form of a constant mechanism of evaluation of the influence, on scientific or general government policy, of results received in the field of basic research? How does this mechanism function?

There is no single mechanism in the U.S. government for evaluating the influence of the results of fundamental research on general government policy. Each agency accomplishes this through a variety of mechanisms. The essential starting point is a scientific and technical capability within the government agency at a sufficiently high level to influence policy, a capability that can identify, acquire, and translate the results of basic research in a policy and program context. Government agencies often utilize advisory panels in assessing the results of basic research, for the purposes of policy and program formulation.

The National Academy of Sciences is engaged in a study of the scientific basis for regulatory policy development by the Environmental Protection Agency. It is possible that this study, as it proceeds, could be drawn on as the basis for a case study of the process whereby the results of basic research on the physiological effects of toxic materials are related to the setting of environmental safety standards.

Issue 4. Are formalized methods of decision making used in the determination of policy in the area of basic research?

Formalized methods are not systematically employed by the U.S. government in determination of policies for basic research, but there is growing interest in the subject. For example, the National Science Board of the National Science Foundation has published a report on Science Indicators which attempted to assess the "health" of science, using indicators largely on the input side (e.g., trends in government support of research). A second Indicators report is now in preparation, which will extend the earlier study to add indicators on the output side, such as information on total refereed literature produced in the U.S. since 1960 in major fields of science and the associated scientific manpower and dollar investment. Another study is examining some 200 major technologies over the past 20-25 years, tracing them back to the basic patents derived from fundamental scientific investigations. Such studies can provide crude guides to assist in judging the adequacy of the overall investments in basic science. A case study could critically review these and other attempts to develop

indicators of the effectiveness of basic research and analyze possibilities and limitations of such retrospective studies in the formulation of policy in the area of basic research.

Despite inherent difficulties in attempting to develop formalized methods to assist in the allocation of resources among fields of basic science due to the unpredictability of the results and applications of basic scientific research, government departments and agencies with applied missions do make judgments on relevance and priorities in determining the level and distribution of their investments in basic scientific research. The Department of Defense, for example, was required by law to justify that each basic research project financed by the Department of Defense was "relevant" to its mission. Although this legislative requirement is no longer in effect, budgetary limitations have continued the pressure for relevance, and the Department has developed methodologies and guidelines for the determination of relevance of the basic research projects and programs. The National Institutes of Health and the Atomic Energy Commission have also applied certain relevance criteria, at least implicitly, in making resource allocations among and within fields of basic science. A case study could be undertaken on practices and conceptual problems facing government administrators in judging the relevance and relative priorities of basic scientific research.

Outside the government, the measurement of cost/effectiveness of basic research and the contributions of research to economic growth have attracted the attention of scholars. A report of the National Academy of Sciences in 1972, "Physics in Perspective," attempted to rank relative priorities within physics, as well as to forecast potential long-range applications of basic research and physics. Although formalized techniques for making policy decisions on support of basic science have not been developed, the U.S. side could undertake a case study that would assess the state of the art of the possibilities and limitations of development of such formalized methods, drawing upon experience and research relevant to this question from within and outside the government.

Issue 5. Is a programmed approach used in the planning of basic research? Has there been any experience in creating programs in the field of basic science? What factors interfere with successful application of such a programmed approach?

Case studies could be undertaken of two types of planning that have been employed in the planning of basic research:

1. Planning leading to the development of coherent programs of basic research in fields of science having special national importance.
   a. In the early 1960's, a policy decision was made to strengthen national capabilities in oceanographic research. It was recognized that new oceanographic research ships were needed and that the scientific manpower base should be greatly extended beyond the small numbers of professional "oceanographers" to include biologists, physical chemists, physicists, and other disciplines that had not been substantially engaged in marine research. A ten-year projected program of research support and ship construction was formulated, but its implementation posed many problems in the translation into policy and program decisions.
   b. Similar case studies could be undertaken of the development of national programs in atmospheric sciences, in materials sciences, and in high energy physics.

   All of the foregoing examples of a programmed approach to basic research involved difficult problems of organization, time phasing, and financing. Maintaining a balance between facilities construction and research support has proved to be particularly difficult in high energy physics and oceanography. All of the programs were faced with the need to develop procedures to assure access to such specialized research facilities of scientists and "user groups" in addition to research staff in residence at those facilities. Such case studies could also reveal the problems and methods of coordinating the basic science programs of several government agencies as part of a coherent, concerted government-wide effort. A related aspect of considerable importance is the problem of maintaining stability and longevity of funding for these programmatic efforts.
2. Another, more recent, example of a programmed approach to basic research is the National Cancer Research Program aimed at understanding the causes and means of prevention of cancer. A case study could critically examine the scientific and conceptual basis for planning biomedical research in the cancer program and the relationships of these plans to allied areas of basic scientific investigation.

Issue 6. Is there a mechanism of incentives for basic research in certain fields of science in which expected results could have an important influence on the development of specific applied research or development?

1. The examples identified in Issue 5 could also serve to illustrate the mechanism of incentives for basic research in fields of science of especial governmental interest. The planning and resulting policy decisions to undertake such national basic science programs have been implemented by increased allocations of funds. Research is carried out in in-house laboratories, the universities, and sometimes in industrial laboratories. Interest is stimulated largely through programs of research grants to attract established and newly trained scientists, of fellowships and training grants, of facilities grants and contracts, and of grants to strengthen or create research capabilities in the universities.
2. Another possible case study on this issue is suggested by the recent special allocation of some $50 million for basic research related to the Federal energy research and development program. Such a case study could analyze the factors surrounding the decision to add this basic science component to the national energy research and development program, the criteria for determining the amount and distribution of funds for basic research involved, and the relationships of the basic research to the state of energy technologies.
3. Still another case study could be undertaken of a relatively new program of the National Science Foundation, Research Applied to National Needs. The NSF program is designed to:

   - Support research efforts in many fields of science to provide the basic knowledge necessary to underpin the applied research efforts of other agencies; and to provide a basis for assessing such applied efforts.
   - Pursue important fundamental research findings to determine possible applications to current or future problems.
   - Support research efforts that are related to the responsibilities of several agencies in order to provide a more comprehensive and coordinated effort than could be conducted individually or collectively by other agencies.

- Support research related to problems that are not clearly within the responsibility of any other agency.
- Utilize its special relationship with educational institutions to bring academic research talent to bear on such problems.

This programmed research of the National Science Foundation is closely coordinated with other departments and agencies, and it is intended that many of the research projects supported by this program will be transferred in whole or in part to other federal agencies as they move beyond the research stage toward development or implementation. Although there has been little time to assess the productivity of this program, and the program is relatively small in size, the concepts underlying the formulation of the program, its methods of project selection and support, and its ability to serve other agencies of government might prove of interest to the Soviet side, in that it illustrates an innovative approach to providing incentives for the conduct of basic research related to domestic problems.

Issue 7. What inadequacies exist in the system of grants? How can the conservatism of this system be overcome in which the distribution of resources is determined by past scientific successes of the research management?

This issue suggests the possibility of an in-depth case study of the policies and practices of federal agencies for the support of basic research in the universities. Such a study would examine the systems for arriving at judgments on quality of proposals for basic research including the operation, strengths, and weaknesses of the various systems of reviewing and evaluating proposals for basic research, such as the peer review and referee approaches. It would examine attempts to make retrospective assessment of the quality of the selection process, such as citation indexing. It would treat questions related to graduate training and the use of post-doctoral fellows in the conduct of research supported by grants. In particular, it would address the question of the extent to which the system of project review introduces bias in favor of established scientific investigators and of ways to encourage new researchers. Additionally, such a study of the grant system would examine the relative roles and responsibilities of outside reviewers vis-a-vis those of the research administrator within the government agencies responsible for program and policy decisions.

Issue 8. What mechanism is utilized to concentrate significant resources in narrow fields of basic research? How effective from the point of view of implementing a science policy is the concentration of basic research in specialized institutes (scientific centers)? Under what circumstances in the conduct of basic research is it considered desirable to create new scientific research organizations?

1. The concentration of significant resources in specialized scientific centers usually occurs in the case of basic research involving very expensive research facilities.

   There is no single mechanism used within the federal government to bring about such concentration, but it might be instructive to undertake a case study that assesses experience with such concentration of resources and the resulting effects on other research institutions and on the development of the scientific disciplines involved. Such a study might, for example, cover the following cases:

   a. oceanography--the establishment and operation of the two major centers for oceanographic research: the Woods Hole Oceanographic Institution and the Scripps Oceanographic Institution.
   b. high energy physics--the establishment of the National Accelerator Laboratory, Batavia, Illinois.
   c. atmospheric sciences--the establishment of the National Center for Atmospheric Research, Boulder, Colorado.

2. Another type of case study could be made of the steps that led to the government decision in the early 1960's to strengthen research in materials sciences, and the creation of multidisciplinary materials research laboratories at universities having strong capabilities in the scientific disciplines involved. Such a study could assess the basis, effectiveness, and results of this policy decision.

Subdivision II. Planning of Basic Research

Issue 9. What period of time is covered in planning basic research in organizations financed by the federal government? What determines the time period covered in planning basic research?

There is no fixed period of time covered in planning basic research in government organizations. To the extent that long-range planning is practical,

it is undertaken at the agency level in the context of the research needs of a particular agency. There is no single, overall "plan" for the support of basic research.

1. A case study could be undertaken of basic research involving very expensive facilities with long lead times for their construction; planning must have fairly long time horizons. There is need to consider alternative facilities possibilities in various time frames, taking into consideration relative priorities from the standpoint of the growth of the field, obsolescence of the facilities, and the quality and number of scientists that would utilize the research facilities during the time period involved. These questions and interrelationships could be brought out in case studies of the high energy particle accelerator program (where 10 year program projections were made at different times), and the ground based astronomical facilities construction program that drew heavily on a report of the National Academy of Sciences, which assessed relative priorities of needed astronomical facilities. The study could include an appraisal of the decision-making process that led to the decision to construct the Very Large Array radio-astronomy facility.
2. The problem of long-range planning of "little" basic science not focused on a few costly research facilities is different in character, and could be the subject of a separate case study. Federal funds now support over 50 percent of academic research over-all, which is an appreciable part of total government support of basic science. Since such research at the universities is funded by several government agencies (particularly, the National Science Foundation, the National Institutes of Health, the Atomic Energy Commission, the National Aeronautical and Space Administration, the Department of Defense) which operate on the basis of annual budgets, it is particularly difficult to plan basic research support on a stable, long-term basis. A differential tightening of the budgets of agencies with mission-oriented research could result in dislocations in the research of the universities without regard either to the overall balance of the nation's basic scientific effort or to the health and stability of the university. Because the private universities are substantially more dependent on federal funds for research than the national average, they are especially vulnerable to such budgetary actions.

Agencies have followed different practices in the past to provide continuity of support of their basic science programs at universities, but budgetary stringencies have generally reduced assured funding to the appropriation available to the funding agency during a given fiscal year.

A case study could be undertaken of the effects of agency funding patterns and fluctuations in support of basic scientific research on U.S. academic research institutions over a five to ten year time period, with consideration of their effects on the planning and continuity of basic research.

sue 10. How is analysis conducted regarding the state of basic research being carried out in the government sector? Are formalized methods used to analyze the state of basic research (e.g., evaluation, using many criteria, of the state of research in the individual fields of science)?

In 1963, the Committee on Science and Public Policy of the National Academy of Sciences embarked upon a series of surveys of the status and future needs of various scientific disciplines in relation to the continued advancement of science and the achievement of national scientific goals. To date, reports published in this series include surveys of ground-based astronomy, solid-earth geophysics, chemistry, mathematics, social and behavioral sciences, physics and astronomy, the life sciences, and a survey of materials.

For example, a Committee on Research in the Life Sciences was organized in 1966 to conduct a comprehensive survey of the most complex of the scientific disciplines--the life sciences. The study was divided into two essentially independent efforts--an assessment of the "state of the art" and a comprehensive description of the biological sciences, based on computerized responses to questionnaires sent to approximately 26,000 life scientists throughout the United States. In the state-of-the-art assessment, panels were formed to review the status of a number of such fields. Other panels evaluated the contributions of biological understanding to agricultural practice, to medical practice, to management of renewable resources, to industrial technology, and to the problems of environmental health.

The Survey of Physics, initiated in 1969, explored physics as a discipline and its interrelationships with technology and other sciences. The survey was also concerned with the role of physics in the current national and social context, the structure and operation of the nation's physics enterprise, the cultural and social significance of physics, the roles of basic and applied physics, its manpower and training requirements and problems, the relationships

among government, industry, and universities, and the directions that U.S. physics may take in the 1970's.

In response to a request from the National Science Foundation, an Astronomy Survey Committee was established in 1969 to respond to the following questions: (1) What are the major scientific questions for astronomy? (2) What should be the scientific priorities among them? (3) Are any trade-offs possible to better achieve them? (4) What external constraints militate (for example, manpower)? (5) What is a realistic schedule for the fullfilment of the needs? (6) What optimum strategies are called for to achieve the goals? (7) Are important but non-major facilities developments being missed or lost? (8) How do we compare the value of continuing ongoing systems versus new starts?

More limited state-of-the-art studies have been undertaken by several of the government agencies supporting basic science, but the National Academy studies represent the most systematic, analytical, and comprehensive approach. It might, therefore, be instructive to carry out a case study that compares three or four of the most significant Academy science surveys from the standpoint of methodologies employed, the validity of data obtained and projections made, and the extent to which each influenced basic science program planning within the government, including reasons for success or failure in influencing policies and programs. The related questions of government organization and procedures that conditioned the response of the government agencies could also be addressed.

sue 11 What is the typical mechanism of setting into motion basic research projects financed by the federal government? How often does the initiative on the conduct of new lines of research proceed from organs of the federal government? This issue is related to another question: What is the mechanism of selecting the individual or organization which is to carry out the basic research?

1. This issue has aspects that overlap a number of other issues previously discussed. A cross-cutting approach to a case study of this issue could be undertaken of 4-6 "new lines of basic research" funded by the government in the past 10-15 years. The case study could explore the "dynamics" of the development of new lines of research supported by the government. Such a study could examine the factors that led to the maturing of governmental interest in the scientific field or area of research, where and how the initiative for stimulating governmental [illegible] funding mechanisms, and procedures used to

set the research program in motion. It could assess the role of the scientific community in the process and the response of that community to the new initiatives. Candidate areas of basic science could include: controlled thermonuclear research, molecular biology, ecology, laser research, and more recent interests in chemical catalysis and continental drift.

2. Another case study could be addressed to certain policy issues involved in the selection of individuals and organizations for carrying out basic research. These issues center on the question of whether considerations other than scientific quality per se should influence the distribution of support of basic research. During the 1960's, there was considerable interest in the geographical distribution of the support of academic research and in the development of new centers of excellence in basic science in the universities to make basic research and training opportunities more widely available throughout the country, in addition to the established university "centers of excellence" which have long commanded the bulk of federal support of basic research in the university system. The experience of the National Science Foundation and the National Institutes of Health in addressing the problem of broadening the base of high quality research in the universities could be the subject of a case study of possible interest to the Soviet side.

Subdivision III. Distribution of Resources and Financing of Basic Research

sue 12. How are resources for basic research distributed? (a) How are resources for basic research distributed in different scientific fields? (b) What is the mechanism for distribution of resources among different projects within a scientific field? (c) Are formalized methods used for distribution of resources among different scientific fields? (d) What mechanism exists for distribution of resources among research organizations conducting research in one scientific field?

As indicated previously, there is no single method or organizational capability within the government for distributing resources for basic research in different scientific fields. Basic scientific research is supported by several departments and agencies of government in accord with their mission objectives and needs.

1. At the government-wide level, certain issues involving the funding of academic research are addressed by the Office of Management and Budget during the annual budget review. After separate decisions are taken with respect to the academic research budget proposals of the several departments and agencies concerned, there is a cross-cutting assessment of the cumulative effects of these individual decisions on basic research at the universities. A study of the process at the level of the Office of Management and Budget could reveal the factors considered and the process of resolving the issues involved.
2. The principal decisions concerning balance among and within fields of science are taken by the individual agencies concerned as part of their resource allocation process. It might be instructive to compare methods, techniques, criteria, and procedures used by the National Science Foundation, National Institutes of Health, National Aeronautics and Space Administration, and the Atomic Energy Commission in evaluating the amount and nature of basic science they support, and the trade-offs involved.

This case study could also include consideration of the following questions raised by the Soviet side:

How is financing and financial supervision in the field of basic research conducted? (a) What decision is utilized in allocating funds to very expensive research or for the acquisition of unique equipment? On what level are such decisions made? (b) How is utilization of allocated resources supervised? (c) What form does this financial supervision take and how often does it occur: --at the level of the financing body; --within an individual research organization? (d) Do financing organs trust scientific managers who determine the amount of expenditures for research? (e) Are cost overruns in research permitted? Are the reasons for cost overruns analyzed? Under what circumstances do the financing organs allocate additional resources for completion of research?

ue 13. Is there a comparative evaluation of competing scientific research organizations? What factors are considered in this evaluation? Is there a formalized methodology for conducting such evaluation? To what degree are the name and previous achievements of the director of research taken into account in deciding the question of allocation of resources?

A case study of this issue could focus on situations where there is a limited number of research organizations with unique research facilities, that

are competing for funds in the same area of basic science. From this standpoint, it would be possible to examine the evaluation procedures used by the Atomic Energy Commission in allocating resources among its high energy accelerator and controlled thermonuclear research centers, and by the National Science Foundation with respect to astronomical research centers.

sue 14. Under what circumstances does the federal government continue the financing of basic research carried out in the private sector if the private organization ceases to finance this research?

No instances come to mind where the federal government has continued financing of basic research that is terminated by the private sector. Nonetheless, this is a question that could be examined from a policy standpoint. In such a case study, for example, the circumstances surrounding the decisions by the United States Steel Corporation and the Shell Research Corporation to close their central basic research laboratories could be examined with a view to analyzing the underlying factors and the appropriate role of the federal government in continuing to support such basic research or in finding alternative non-federal mechanisms for such continued support.

ue 15. Is there a practice of inviting leading scientists from abroad to conduct basic research?

There has long been a practice of inviting leading scientists from abroad to conduct basic research in government laboratories, the universities, and in industry. The U.S. basic science program has benefited immeasurably from their participation, and the foreign scientists have gained scientific knowledge and insights from their participation in research in the U.S. and their contacts with American colleagues, as well as an understanding of U.S. organization and management concepts as they involve the conduct of basic research. An in-depth case study of the practices, benefits, and problems experienced by government, the university, and industrial basic research organizations related to the research participation of foreign scientists could be highly instructive both to the Soviet and U.S. sides.

Subdivision IV. Utilization of the Results of Basic Research in Applied Scientific Research Work (SRW) and Applied Experimental Design Work (EDW)

Issue 16. Does there exist a single mechanism for securing speedy transfer of the results of basic research into practice? (a) Does there exist beginning-to-end planning which covers the entire cycle of research--from basic research to EDW --within single projects? (b) Is there a mechanism for stimulating the application of the results of basic research? (c) What factors hinder the quick application of the results of basic research? (d) What organizational forms would best accelerate the quick application of the results of basic research? (e) What mechanism is utilized for the transfer of information on the results of basic research into the sphere of applied SRW and EDW?

There is no single mechanism or systematic method utilized by the U.S. government for securing the speedy transfer of the results of basic research into practice. However, it is possible through retrospective case studies to identify the factors that facilitated such transfer.

1. An assessment could be made of certain case studies previously undertaken that attempted to trace important commercial developments from the underlying basic scientific discoveries to their commercial embodiment. For example, a study by the Materials Advisory Board of the National Academy of Sciences, in 1966, developed certain principles of research-engineering interaction based on case studies of the history of several important and new materials developments where the new possibilities depended on the interaction of fundamental knowledge with the recognition of practical need. The National Science Foundation in its "tracers" report examined the basic science discoveries leading to ferrites, oral contraceptives, and other developments. The case study of the National Science Foundation program on Research Applied to National Needs (discussed in Issue 6) would also be instructive from the standpoint of governmental mechanisms for accelerating the application of results of basic research.
2. Another process of transfer from basic science to application occurs through the movement of academic scientists to industry as consultants, research workers, or entrepreneurs. A case study could be undertaken of this process of mobility as seen from the vantage point of two or three major technological universities--Massachusetts Institute of Technology, California Institute of Technology, and Stanford University.

This case study might include the phenomena observed in the areas surrounding Massachusetts Institute of Technology and Stanford that spawned a number of successful small, high technology companies as the direct result of scientific entrepreneurs originating at those research institutions.

ssue 17. Is possible application of basic research taken into account before the beginning of research or in the early stages of research? (a) Is there a generally accepted practice of evaluating the applied significance of the results of basic research? Who analyzes the potential application of research results--the researcher who obtained them, or the organization which is the potential user of these results? (b) Is the applied significance of expected results of basic research one of the factors which determine the distribution of resources among scientific fields?

This issue has been treated in different aspects of the discussion of other issues. A case study of this issue could touch on relevant aspects of the cancer program, the new program of basic research related to energy technology, and the examination of evaluation criteria used in the peer review of proposals for basic research.

sue 18. How is basic scientific research in the private sector planned and financed, resources allocated, and results transferred to practice?

All of the issues discussed earlier raise counterpart questions for the private sector. It might be of interest to the Soviet side to examine them in the context of several American companies that fund substantial basic science efforts. Such a case study might include, for example, the basic research policies and practices of the Bell Telephone Laboratories, the General Electric Company, the Du Pont Corporation, and the Eastman Kodak Company, among other possibilities.

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INDIANA UNIVERSITY
Department of Chemistry
CHEMISTRY BUILDING
BLOOMINGTON, INDIANA 47401

TEL. NO. 812—

July 20, 1974

Sci Pol

Dear Dr. Filippov:

We were delighted to receive the 29 questions relating to four subdivisions of Topic IV, Systems of Stimulating the Development of Fundamental Research. We have studied these questions carefully, and we believe that they can form the basis of a meaningful exchange of information between us.

We are now preparing brief study plans for a number of these and are arranging for our team of experts to review these in the near future. In order to expedite the cooperative work, however, we will be forwarding to you in advance of that review the draft summaries. Some modifications and additions can be expected by this group, but we hope the result will not differ significantly in form from the advance documents, and these may give you then some indication of the nature of our proposals.

Sci. Policy

Some of your questions can be grouped, we believe, in a way to be answered properly through several, perhaps three, survey papers dealing respectively with a description of policy planning, a discussion of basic research management, and a survey of the transfer of basic research to technology. Many of the others can best be illuminated by a series of case studies descriptive of actual situations we have encountered in recent years.

Altogether we hope to forward to you summaries of 10-15 such studies with a view towards our mutual selection of 4-6 of these for implementation at our next meeting.

As Dr. Beckler has written to Dr. Sklyarov, we hope to be ready to meet with you in the week of September 23 to discuss and to reach conclusions on these studies to be carried out by each side as agreed in the earlier protocol. I propose bringing four or five individuals from my team to facilitate this discussion. In addition I am hoping to bring my wife and one other member of the group presently plans to bring his wife.

We believe it would be most productive of our time to plan to arrive in the Soviet Union on Sunday, September 15. Allowing for the usual problems with jet lag, we would appreciate the opportunity of visiting installations in the Moscow-Leningrad area during that week in order for us to obtain the maximum benefit of understanding of the questions you have raised. We propose that formal meetings of the groups be held the first half of the week of September 23, leaving the latter part of that week for producing the formal protocol of the discussions.

Several of us may be able to remain in the Soviet Union the following week as well, and we hope to have the opportunity of visiting some other parts of your great country, perhaps combining both scientific and touristic purposes.

We hope these suggestions meet with your approval. We certainly are eager to press forward with this important opportunity for exchange of information and for further contacts between us. We look forward to the prospect of seeing you in Moscow in September.

Sincerely,

Harrison Shull

Harrison Shull

HS:mk

Dr. V. A. Filippov
Head, Science Organization Department
Academy of Sciences of the U.S.S.R.
Leninskiy Prospekt, 1y
Moscow, U.S.S.R.

STATINTL [redacted]

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

R. ask!

February 28, 1974

Science Policy

Dr. V. A. Filippov
Head, Science Organization Department
Academy of Sciences of the U.S.S.R.
Leninskiy Prospekt, 14
Moscow, U.S.S.R.

Dear Dr. Filippov:

In accordance with the approved procedures for carrying out the jointly agreed study of the U.S. and U.S.S.R. systems for fundamental research, I am pleased to enclose a list of questions which we would be interested in having the U.S.S.R. side examine. The questions are grouped in relation to seven principal issues.

It is our understanding that you will provide the U.S. side with a one-page summary of the study procedure that would be followed in examining each of these questions. The summary statement would, in effect, be a study outline and plan for each question. We will then select approximately 10 of the summaries for further development of final study procedures in advance of a meeting of the joint working group in May. Similarly, upon receipt of your list of questions, we will prepare a one-page summary of our proposed study plan for each question and invite your selection of about 10 studies for consideration at the May meeting, at which time 4-6 questions would be selected by each side for in-depth study.

In addition to the detailed examination of a number of specific questions, we would like to propose the preparation of general survey papers by each side on each of the first four issues: (1) the planning of fundamental research; (2) the financing of fundamental research; (3) the conduct of fundamental research; and (4) application of the results of fundamental research. A detailed description of each of the foregoing components of the national systems for fundamental research would provide a perspective for assessing the in-depth studies of specific questions and facilitate mutual understanding of the similarities and differences of the U.S. and U.S.S.R. fundamental research systems as a whole.

We further suggest that Issues VI and VII be addressed as general questions with selected in-depth case studies to illustrate the scientific advisory process and the possibility for joint studies between the two Academies.

Science Policy

I look forward to receiving your list of questions for consideration by the U.S. side and hope that you will agree to the preparation of survey papers on selected issues along the foregoing lines.

It was a great personal pleasure to meet and work with you last November during the session of the joint group of experts.

Very truly yours,

Harrison Shull

Harrison Shull

Enclosure

NATIONAL ACADEMY OF SCIENCES
2101 CONSTITUTION AVENUE
WASHINGTON, D. C. 20418

Questions of Interest to the U.S. Side of the U.S.-U.S.S.R. Academies Joint Working Group on Fundamental Research

Issue I: How does the U.S.S.R. plan for fundamental research?

1. By what mechanisms is the overall level of support of fundamental science determined; and how are the overall objectives for fundamental science determined?

2. How are priorities and allocations of resources within fundamental science determined?

   a. What role does cost/benefit analysis play in determining priorities and levels of support?

   b. What role does quality and quantity of educated personnel available in a field play in determining these priorities?

   c. What mechanisms are used to determine an appropriate balance to expenditures for "big" science and "little" science?

   d. What mechanisms and criteria are used for the selection of a particular large facility for funding among a number of such possibilities?

   e. How does the U.S.S.R. identify and support the development of fundamental research in neglected areas of science (ones that are currently unpopular or seem obsolescent or less useful at present)?

   f. Does the U.S.S.R. deliberately seek out sponsorship of unorthodox projects and provide financial support for them?

3. What is the distribution of responsibility for formulation of fundamental research programs and projects among individual scientists, institute and laboratory directors, the Presidium of the AN, the State Committee?

   a. To what extent are professional planners who are not primarily scientists involved?

   b. To what extent do individual investigators formulate research projects? How are they reviewed? How is the level of funding determined?

4. To what extent and by what process is the formulation of fundamental research targeted toward particular societal goals?

   a. Where fundamental research is planned in relation to a specific problem, e.g., cancer, how is the program formulated and what is the underlying rationale?

   b. How is the planning of fundamental research related to the needs of industry?

   c. To what extent and how does the possible transition from basic research to applied research and development affect the planning for fundamental research?

Issue II: How does the U.S.S.R. organize the financing of fundamental research in general and in particular fields of science?

5. How does the U.S.S.R. ensure long-range funding for projects which are by necessity long term in nature? How is institutional financial stability assured in the face of changing year-to-year priorities in fundamental research?

6. What are the diverse sources of financial support and what is the flow of funds from the source to the performer of the research?

   a. How are budgets for fundamental research prepared? How audited? At national level, institutional level, individual level?

   b. Does fundamental research financing contain a component devoted to regional development of fundamental research capability? How is the level of this determined? What distributional criteria are used?

7. What kinds of different financial support mechanisms are used; and what is the distribution of funds among these mechanisms?

   a. What dictates the choice of mechanisms and level of support for a given mechanism (contracts, block grants, project proposal grants, unrestricted grants to individuals)?

   b. What special financial mechanisms are used to encourage inter-disciplinary research?

8. How does the U.S.S.R. finance service areas to fundamental research?

   a. Is there special support of instrumentation development?

   b. How is computational support and the support for bibliographic translation and retrieval determined and provided?

   c. [illegible] factors in instrumentation and laboratory design?

Issue III: How does the U.S.S.R. conduct its fundamental research program?

9. By what mechanisms does the U.S.S.R. determine whether the conduct of fundamental research corresponds with the planning? How does the U.S.S.R. monitor research in progress?

10. By what mechanisms are choices made (1) between performing institutions and laboratories for conducting the planned research or (2) for the establishment of new research centers or laboratories? To what extent does the U.S.S.R. encourage deliberate competition of effort for fundamental research?

11. What special mechanisms or policies exist for ensuring the maximum utilization of scientific personnel?

    a. How are promising young investigators identified and support directed to them?

    b. How are older scientific personnel utilized or gracefully retired from the system?

    c. Are there procedures for reorienting, reinvigorating or closing laboratories?

12. Does the U.S.S.R. conduct fundamental science in industry? How is it organized and how is the level of such research determined?

13. What are the U.S.S.R. policies and practices with regard to the mobility of scientists?

    a. Does the fundamental research program encourage mobility of scientists between institutions (research institutes, universities, industrial enterprises, government), between different regions of the country, between different fields of scientific activity?

    b. What are the considerations underlying the U.S.S.R. policies with regard to international scientific cooperation and mobility of Soviet scientists, including attendance at international scientific meetings and international exchanges of scientific personnel?

Issue IV: What are the policies and mechanisms used to encourage the transfer of fundamental research knowledge to applied research and development?

14. What mechanisms does industry use to acquire and utilize current knowledge of advances in fundamental research?

a. What mechanisms are used to transmit information of fundamental research knowledge gaps crucial to industry to those carrying out fundamental research?

b. What mechanisms are employed to encourage mobility of individuals between industrial research and fundamental research?

c. To what extent and by what mechanisms is information shared between different industrial research and development performers? By what mechanisms are trade secrets preserved?

15. What are the incentives to encourage individual initiative to bring to practice new fundamental research ideas? What obstacles can be identified discouraging the transfer of knowledge, ideas, and inventions resulting from fundamental research?

Issue V. Are there meaningful indices for comparing U.S. and U.S.S.R. efforts in fundamental research?

16. What similarities and differences exist in the U.S. and U.S.S.R. efforts in fundamental research?

a. expenditures over time (retro- and pro-spective) of support of fundamental science

b. shifts of expenditures between fields

c. utilization of scientific personnel

d. publication outputs (citation analyses, etc.)

e. tracers to show relationships of specific fundamental research to technological development

f. choice of support of "big" science projects

g. attitudes towards international cooperation in large fundamental science projects

Issue VI. How is scientific and technical advice utilized in the development of policies and programs?

17. What are the mechanisms by which scientific advice is made available to the government for policy planning?

a. What levels of decision making in the government can be identified which have a component of scientific advice or input? Who are the individuals or groups that give this advice? How are they chosen? What is the mechanisms by which the advice is given?

b. When decision makers perceive the need of scientific advice, to whom do they turn?

c. When scientists perceive that scientific information would be important to the decision makers (even though the latter may not recognize the need themselves), how can that input be made?

d. What are the advisory mechanisms and processes? How are the individuals selected to play the advisory role? What rotation among advisers occurs?

e. To what extent does an "in" group permeate the advisory structure? What is the role of the Party in selecting scientific advisers? What is the role of the AN in designating scientific advisers? To what extent does AN membership itself constitute entrance to the circle of scientific advisers?

f. What is the relative role of the Presidium of the AN and the State Committee for Science and Technology in providing scientific advice?

g. What other scientific organizations are involved in governmental decision making advice? How?

Issue VII: What joint studies may profitably be carried out between the two Academies?

18. What studies have been completed in the past three years and what studies are in progress? What problems can be suggested for future joint study, including updating of the earlier studies, complementing studies already carried out, or new studies by jointly constituted committees on problems of mutual interest, e.g., effects of long-term climatic trends, radioactive waste disposal, reactor safety?

CIA

CSS - Ruth

Army (2 copies - 1 of them w/ Wayne's name for [redacted])

STATINTL

AF
NAVY
ARMY
DIA
Commerce
SB
DER
Ellie
OSI

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} on the cards to these 3 Type. Please check + let me know if any of your analysts were involved in formulating these questions

25X1A

Thks [redacted]

ROUTING AND RECORD SHEET

SUBJECT: (Optional)

Science Policy 25X1A

FROM: [redacted] STATINTL

EXTENSION: 2402

NO.

DATE: 15MAR74

TO: (Officer designation, room number, and building)	DATE RECEIVED	DATE FORWARDED	OFFICER'S INITIALS
STATINTL			STATINTL
1. [redacted] OSI/EO Services Branch Rm 6F30 Headquarters	3/18	3/21	[redacted]
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3. Exchanges Staff 902 Key			
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COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)

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Thanks,

STATINTL [redacted]

[redacted]

By the way, there are pretty good questions.